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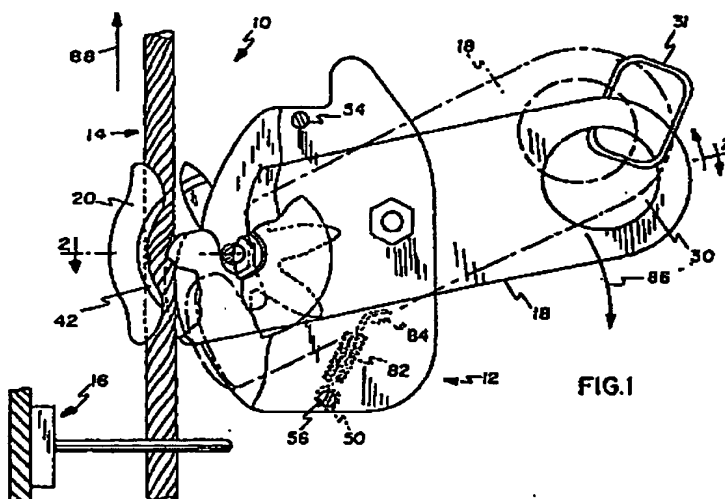
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(54) **Bypassing double action rope grip**

(57) A safety system for protecting workers at high altitudes from falling to the ground is disclosed. The system features a rope grip (12) having a rotably mounted wedge (18) in spaced facing relationship with a retaining member (20). The safety line (14) is

jammed between the retaining member (20) and the wedge (18). The rope grip (12) is able to bypass an anchor (16) by virtue of the fact that the retaining member (20) is held in place by rotating slotted wheels (44,46).

**FIG.1**

Technical Field

The invention relates to a rope grip and safety system for protecting workmen working at high altitudes from falling to the ground.

Background Art

In the past, much effort has been devoted to development of fall prevention devices known as rope grips. The desirable qualities of such a device fall into several categories including safety, reliability, versatility, and convenience of use. Dodge Machine Company, Inc. commonly offers a rope grip with a number of desirable qualities, for example the rope grip is manufactured from large pieces of material which distributes the impact of a fall to relatively massive pieces of metal providing strength, reliability and safety.

Another commercially available rope grip is the Barrow-Hepburn-Everest Rope Grip, patented in the U.K. with Patent No. 1,077,068. This rope grip operates by means of three small steel balls through which a rope is passed. When the rope grip begins to fall rapidly down a rope, the friction of the rope against the balls draws them into a conical shaped housing which jams the rope between the three balls. While this device offers advantages over many others in fail safe operation, it has practical drawbacks too. For example, this device can only be used with a very narrow tolerance in rope diameter. Moreover, the rope must be threaded through the grip, as it can not be opened for placing the grip on the rope.

In U.S. Application No. 501,623 filed on June 6, 1983, a removable double action rope grip is disclosed. This rope grip takes care of many of the practical disadvantages of the prior art, however many problems still remain. In particular, it is often desirable to anchor vertical safety lines on the surface of a nearby structure. According to existing specifications issued by OSHA and other such safety organizations, a safety line should be held in place at least every thirty feet so that it does not blow and flap around in the wind. Whatever means are used to anchor the safety line will, of course, present an obstacle to a rope grip. Conventional safety devices for use on inclined lines cannot pass such an anchor, and therefore the rope grip must be removed from the line and reattached at the desired position.

The Latchway (Registered Trade Mark) Cliprider System manufactured and marketed by Barrow-Hepburn Equipment, Ltd. of London, England, discloses a safety system that allows workers to move past clips holding a horizontal line in place. In addition, this system has special fittings which allow a safety device to be put on or re-

moved from a cable anywhere in the system.

United States Patent Serial No 4,265,179 to Tupper describes in detail various aspects of the Cliprider system. By way of summary, the Latchway System is merely a means for protecting a worker by use of a horizontal safety line, and does not provide for arresting movement along the line. That is to say, the worker, is protected by a horizontal line while he is working on more or less the same level. This, of course, would not be suitable for use by workers who are climbing long ladders such as found on water storage tanks, television transmitting towers, smokestacks or the like, where a vertical safety line is needed.

Disclosure of Invention

The present invention relates to a safety system for protecting workmen working at high altitudes from falling to the ground, and more particularly relates to such systems which use a vertical safety line anchored in place along its length.

It is accordingly an object of the present invention to provide a rope grip which can bypass the anchors holding the line in place without being removed from the safety line.

It is another object of the invention to provide a safe, reliable means for arresting movement along a line.

It is a further object of the invention to provide a rope grip which is simple to manufacture and easy to use.

In accordance with the present invention it has been found that, in a safety system including an inclined cable secured at a plurality of points by a plurality of hangers, a rope grip having a guide plate supported by two rotably secured, slotted wheel-like members will obtain the above mentioned objects. The guide plate is maintained in a facing relationship with a rotably mounted wedge, thereby defining a passage for receiving a rope. The wedge is positioned, configured and dimensioned to jam the cable against the plate upon rotation.

Brief Description of Drawings

One way of carrying out the invention is described in detail below with reference to the drawings which illustrate only one specific embodiment of the invention in which:-

Figure 1 is a side plan view, in partial cutaway, of the inventive safety system;

Figure 2 is a top plan cross-sectional view of the inventive rope grip shown in Figure 1;

Figure 3 is an exploded perspective view, reduced in size, of the inventive rope grip shown in Figure 2;

Figure 4 is a diagrammatic side plan view of the inventive safety system wherein the rope grip is approaching an anchor from below;

Figure 5 is a diagrammatic side plan view of the inventive safety system wherein the rope grip is moving past an anchor;

Figure 6 is a diagrammatic top plan view of the inventive safety system shown in Figure 4; and

Figure 7 is a diagrammatic side plan view of the inventive safety system wherein the rope grip has merely completed bypassing an anchor.

Best Mode for Carrying Out the Invention

Referring to Figure 1, the inventive system 10 is shown. The system comprises generally a rope grip 12, a vertical line 14 and an anchor 16 for securing the line. Figure 2 more clearly shows rope grip 12 disposed about line 14. A channel for receiving the line is defined by a wedge 18 and a retaining member 20.

The details of the construction of inventive rope grip 12 are illustrated in Figure 3. The inventive rope grip has side plates 22 and 24. The wedge has a large hole 30 which may be used to attach rope grip 12 to a user by means of a ring 31 attached to a harness or any other suitable means. Retaining member 20 also has a pair of lips, 40 and 42 respectively as seen most clearly in Figure 2.

Inventive rope grip 12 has a pair of slotted wheels 44 and 46 whose spokes have a plurality of slots 48 which are adapted to hold retaining member 20 in a facing relationship with wedge 18. This is accomplished by having lips 40 and 42 correspond with the rotation radius of slots 48.

The remaining parts shown in Figure 3 are largely for the purpose of assembling the rope grip. Wedge 18 is disposed between side plates 22 and 24 along with threaded spacers 50 and 52. The side plates are held together by screws, such as screws 54 and 56 which are threaded into spacers 50 and 52, respectively.

Wedge 18 is pivotally mounted between side plates 22 and 24.

Two washers, 58 and 60 are positioned outwardly with respect to wheels 44 and 46. The washers have rubber portions 62 and 64 which eliminate unwanted rigid protrusions and inner steel portions 66 and 68 for their mechanical properties so that the wheels will be securely held in place.

A main shaft 70 is placed through the hole in washers 58 and 60 and through the central holes in slotted wheels 44 and 46, the arrangement being illustrated in Figure 3. The shaft has threaded ends which are secured by nuts 76 and 78. The nuts cannot be overly tight inasmuch as wheels 44 and 46 must be free to rotate as will become apparent

in the discussion which follows.

Before main shaft 70 is secured in place, lips 40 and 42 of retaining member 20 must be properly positioned with respect to slots 48 of wheels 44 and 46. Lips 40 and 42 are held by slots 48 of the spokes of which four are shown in Figure 2. A bolt 80, not shown in Figure 3, is illustrated in Figure 2.

A spring 82 is at one end attached to wedge 18 and at its other end is connected with respect to the side plates 22 and 24.

Figure 1 illustrates the clamping action of the rope grip. Rope grip 12 has been designed with spring 82 exerting a pressure on wedge 18 urging rotation in the direction of arrow 86. Spring 82 does not exert enough pressure to overcome the weight of the rope grip and therefore when a pressure is applied on the arm, as would be the case when the grip is hanging from the belt of a user, the rope grip 12 may be raised or lowered along line 14 without having wedge 18 jam the line against retaining member 20. Thus, a user's hands remain free while ascending or descending along the rope provided that rope grip 12 is properly attached.

However, if a person falls and therefore releases upward pressure on the wedge arm, spring 82 will cause rotation of the arm in the direction indicated by arrow 86. As the wedge touches line 14 which is moving upward through rope grip 12 in the direction indicated by arrow 88, the line will pull the wedge into jamming position. It should be noted that both retaining member 20 and the surface of wedge 18 facing member 20 have concave surfaces 90 and 92 for accommodating line 14.

Both surface 90 of member 20 and surface 92 of wedge 18 are substantially perpendicular to the axis of rotation of wedge 18. Member 20 remains substantially stationary with respect to the axis of rotation of wedge 18 however the wedge, and particularly surface 92 thereof, rotates. The distances from various parts of surface 92 to the axis of rotation of wedge 18 vary in much the same way as the distances from a side of a rectangle to a point thereon. Thus, as wedge 18 rotates about its axis of rotation the passage defined by surfaces 90 and 92 is restricted and the grip arrests movement along the line.

When upward tension is removed from wedge 18, the grip has more weight towards the extremity of the arm, in the vicinity of hole 30, than at the end of the grip through which the rope passes. Therefore when there is no upward force on the rope grip, the entire unit tips downward, in essence causing rotation of wedge 18 in the direction indicated by arrow 86. This brings the wedge end of the arm against the rope which, in turn, pulls the wedge up into jamming position as the grip travels along the line.

The operation whereby rope grip 12 bypasses an anchor 16 is illustrated in Figures 4 to 7. Figure 4 shows the grip approaching an anchor from below. A top view of the same is shown in Figure 6. Anchor 16 is configured to fit between side plates 22 and 24, member 20 and wedge 18. As rope grip 12 advances along the line, wheels 44 and 46 rotate so as to allow the grip to bypass anchor 16. During the process illustrated in Figures 4 to 7, the retaining member remains held in place by slots 48 of the spokes of the rotating wheels. The dimensions of lips 40 and 42 of retaining member 20 and the distance between slots is such that the two slots are always securing each lip.

If a user feels he is falling and puts his hand on line 14 directly above the grip, his hand will slide down the line until it contacts the device at which point the hand touches the upper ends of the side plates 22 and 24 which drives the upper part of the grip away from the rope. The wedge will then come into contact with the line and be urged into jamming position.

While an illustrative embodiment has been described, it is of course understood that various modifications will be obvious to those of ordinary skill in the art. These modifications are within the spirit and scope of the instant invention which is limited and defined only by appended claims.

Claims

1. Rope grip comprising:

- (a) guide means for defining a first gripping surface;
- (b) operator means for defining a second gripping surface, said first and said second gripping surfaces defining a passage for receiving a rope therebetween;
- (c) support means for rotably supporting said operator means so that said second gripping surface is in a facing spaced relationship with said first gripping surface, said operator means being dimensioned so that said second gripping surface will define a plurality of radii about its axis of rotation thereby changing the dimensions of said passage upon rotation of said operator means;
- (d) a pair of rotably secured support members with a plurality of spokes having coupling means for supporting said first gripping surface, said guide means being adapted to be supported by said coupling means so that said rope grip will jam a cable between said first gripping surface and said second gripping surface upon rotation of said operator means, said support members being positioned configured and

adapted to allow said rope grip to pass obstacles of specific dimensions along the cable;

(e) securing means for securing said rope grip to a user; and

(f) spring means for urging said operator means to a position for jamming a cable, in use extending through said passage, upon removal of tension on said operator means.

- 2. Rope grip according to Claim 1, wherein said support means comprises a housing protruding outwardly of the peripheries of the support members.
- 3. Rope grip according to Claim 2, wherein said operator means comprise a rotary cam member and said spring means comprises a spring attached to said cam, the weight of said rope grip being sufficient to provide rotational force to overcome the force exerted by said spring on said cam when said rope grip is suspended from said securing means.
- 4. Rope grip according to Claim 3, configured and dimensioned so that the center of gravity of said rope grip occurs further from said cable than does the axis of rotation of said cam, whereby said second gripping surface moves toward a jamming position upon removal of support for said rope grip.
- 5. An improved safety system for protecting workmen at high altitudes from falling to the ground of the class, wherein a cable is secured to a wall at a plurality of points by a plurality of hangers and a safety device is disposed about said cable, said safety device having a gripping member secured by two rotating slotted wheel-like members so that said safety device may pass said hangers without being removed from said cable, wherein the improvements comprise an inclined line and a rope grip for arresting motion on said inclined line, said rope grip comprising:
 - (a) guide means for defining a first gripping surface;
 - (b) operator means for defining a second gripping surface, said first and second gripping surfaces defining a passage for receiving a rope therebetween;
 - (c) support means for rotably supporting said operator means so that said second gripping surface is in a facing spaced relationship with said guide means, said operator means being dimensioned so that second gripping surface defines a plurality of radii about its axis of rotations; and

(d) two rotably secured support members with a plurality of spokes having coupling means for supporting said first gripping surface, said guide means being adapted to be supported by said coupling means so that said rope grip will jam a cable between said first gripping surface and said second gripping surface upon rotation of said operator means, said support members being positioned, configured and dimensioned to allow said hangers to pass between said first gripping surface and said second gripping surface; and

(e) spring means for urging said operator means to a position for jamming said cable upon removal of tension on said operator means.

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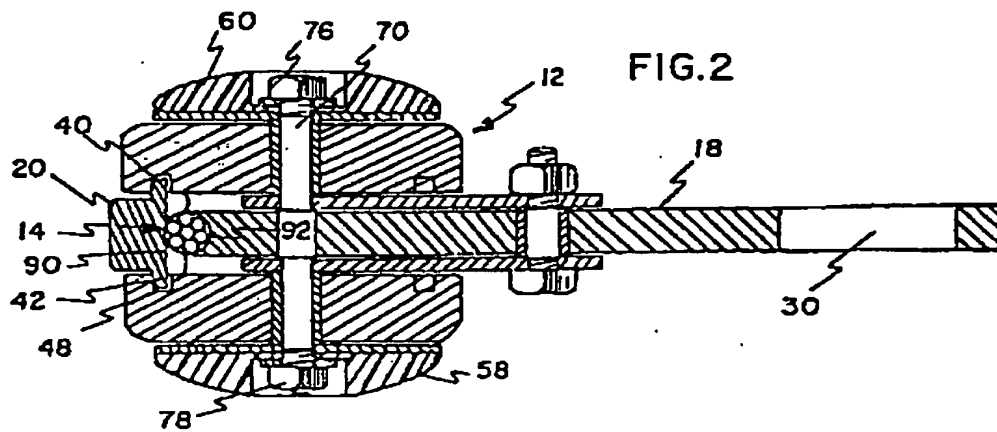
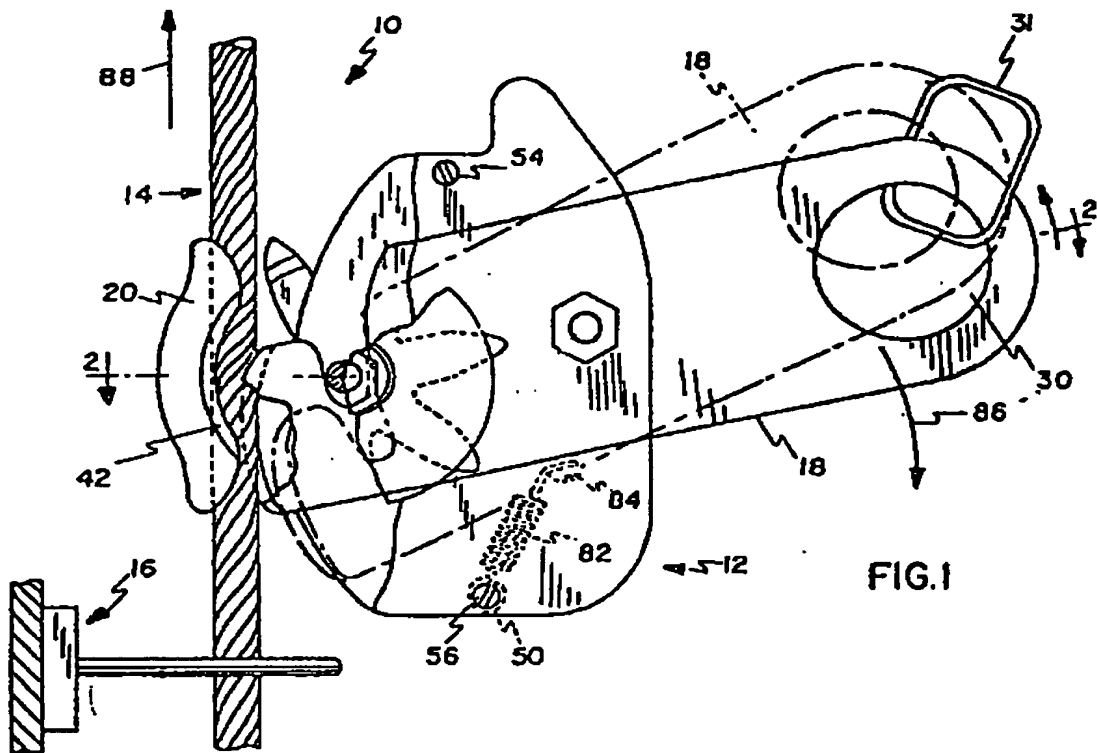
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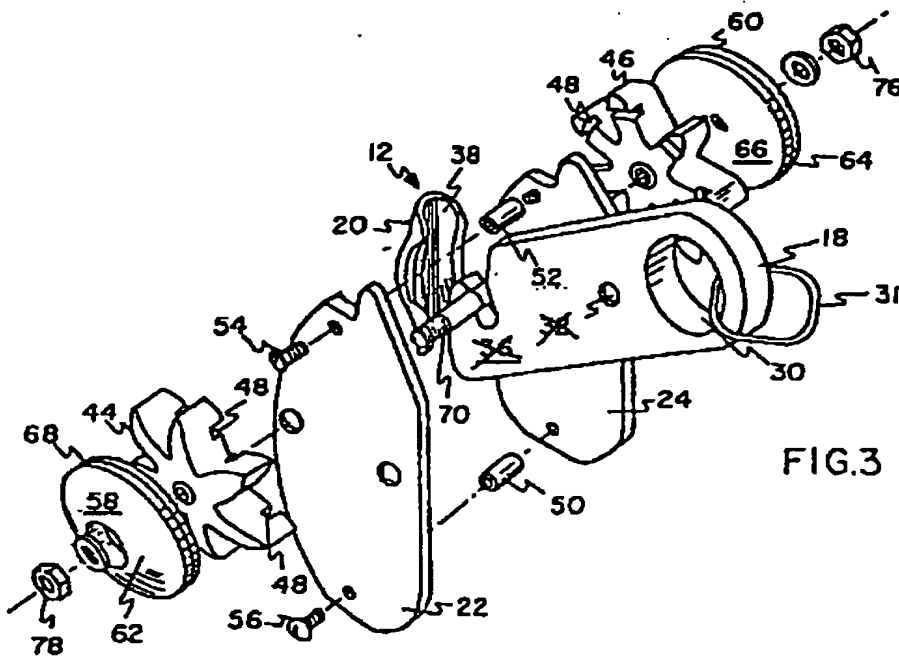


FIG. 3

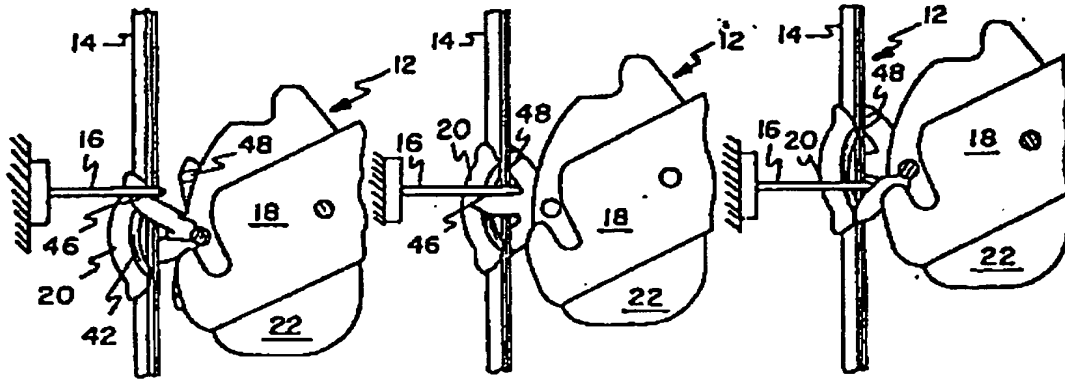


FIG. 4

FIG. 5

FIG. 7

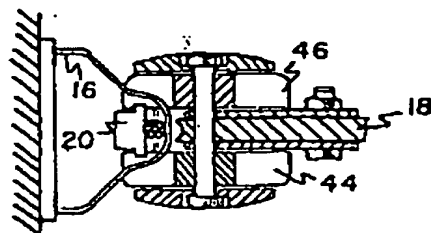


FIG. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 90 30 4744

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. CL4)
Y	GB-A-2 096 959 (TUPPER) * abstract; figures * * page 3, line 67 - line 90 * ---	1-5	A62B35/04
Y	US-A-3 179 994 (MEYER) * figures * ---	1-5	
A	DE-U-77 26 831 (FISCHER) ---	1,5	
A	US-A-4 077 094 (SWAGER) ---	1,5	
A	US-A-4 034 828 (ROSE) ---	1,5	
A	DE-A-32 23 278 (TUPPER) ---	1,5	
A	US-A-3 193 050 (GALANTE) ---	1,5	
A,D	GB-A-1 077 068 (BARROW HEPBURN) ---	1,5	
A,D	US-A-4 265 179 (TUPPER) -----	1,5	
			TECHNICAL FIELDS SEARCHED (Int. CL4)
			A62B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21 March 1995	Examiner Walvoort, B
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- A : member of the same patent family, corresponding document	